

In contrast, prior art tail end knockdown or snubber devices employ either a single snubber member carried on a rotary knockdown wheel, or a plurality of knockdown or snubber members carried in fixed equal circumferentially spaced positions about the periphery of the knockdown wheel. This results in the prior art knockdown or snubber members reaching their product knockdown positions, as represented by the triangular symbols (Δ) 142 in FIG. 9, at equally spaced intervals relative to the path traversed by sheet products moving downstream from the rotary cutter.

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As a result, when sheet products are severed by the rotary cutter from a repeat length of web so that the sheet products are irregularly spaced as they are conveyed downstream from the cutter, the prior art knockdown members do not engage successive sheet products at consistent points of contact relative to their trailing edges 28. By failing to compensate for irregular spacing of the sheet products within a repeat length of web, the distance between the prior art knockdown points of contact 142 and the desired knockdown points of contact 140 increases, thus resulting in a progressively increasing or cumulative error to the point where the prior art knockdown or snubber members actually miss engaging one or more sheet products adjacent their trailing ends and contact the leading ends of the next successive sheet products. --

In the Claims:

Amend claim 7 as follows:

2. (Amended) Apparatus for shingling successive sheet products cut from a substantially continuous web of sheet material, said apparatus comprising, in combination, a variable rotary cutter having a plurality of circumferentially spaced knife blades having cutting edges operative to cut the web generally transversely into irregularly spaced sheet products [of substantially equal longitudinal lengths] having leading and trailing edges, first conveyor means for

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receiving said sheet products in successive fashion from said rotary cutter and defining a first conveyor path along which said successive sheet products are conveyed in irregularly spaced relation at a first longitudinal speed, second conveyor means having an upstream end for receiving said sheet products in successive fashion from said first conveyor means and defining a second conveyor path along which said sheet products are conveyed at a slower longitudinal speed than said first longitudinal speed, knockdown means including at least one rotary knockdown wheel spaced generally above and [generally] adjacent said upstream end of said second conveyor [means] *34* path, said knockdown wheel having a plurality of knockdown members adjustable in circumferentially spaced relation about an outer periphery of said wheel, said knockdown members being at least equal in number and circumferential angular position to [the number of] said knife blades on said rotary cutter that establish said trailing edges of said irregularly spaced sheet products [and being positioned about the outer periphery of said wheel] so that outer surfaces of said knockdown members are operative to engage and depress successive sheet products generally adjacent their trailing edges as said irregularly spaced sheet products pass from said first to said second conveyor [means] paths whereby to enable shingling of successive sheet products, and means for rotating said knockdown wheel in phase relation to said rotary cutter so that said outer surfaces of said knockdown members have a tangential velocity substantially equal to the tangential velocity of said knife cutting edges during operation of said apparatus.

Amend claim 16 as follows:

B5 11.16. (Amended) A system for producing printed sheet products, comprising, in combination, a rotary print cylinder operative to produce a plurality of printed products on a continuous length longitudinally moving web during each repeat of the print cylinder, a [variable] rotary knife cylinder downstream from said print cylinder and having a plurality of

circumferentially spaced knife blades operative to sever the web generally transversely so as to create individual irregularly spaced printed products having leading and trailing edges, a first conveyor operative to receive said individual irregularly spaced printed products from said knife cylinder and convey said printed products at a first speed, a second conveyor operative to receive said irregularly spaced printed products from said first conveyor and convey said products at a slower speed than said first speed, a headstop [means] operatively associated with said second conveyor for cooperation with each successive printed product to momentarily decelerate movement of each said successive printed product received from said first conveyor when the trailing edge of each said printed product is adjacent an upstream end of said second conveyor, and at least one knockdown wheel supported adjacent said upstream end of said second conveyor, said knockdown wheel having a plurality of kicker members disposed in substantially the same circumferentially spaced relation about its periphery as said knife blades that create said trailing edges and being at least equal in number to, or a whole integer multiple of, the number of [printed products created by said print cylinder during each repeat revolution thereof] said knife blades that create said trailing edges, said knockdown wheel being positioned and rotated so that each kicker member engages the trailing edge of a printed product at substantially the same position relative to the trailing edge when the leading edge of said printed product engages said headstop ~~means~~ to facilitate shingling of successive printed products passing from said first to said second conveyor.

Amend claim 17 as follows:

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17. (Amended) In a delivery system for receiving a printed web from a rotary print cylinder operative to print a plurality of equal length irregularly spaced printed products on each repeat length of the web, said system further including a variable rotary knife cylinder having a plurality of knife blades thereon positioned in circumferentially spaced positions so as to sever each

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said repeat length of web [so as to] and create irregularly spaced individual [equal length] printed products having leading and trailing edges, a first conveyor for conveying said individual printed products from said knife cylinder along a predetermined path at a first speed, and a second conveyor having an upstream end adapted to receive said printed products from said first conveyor and convey said products at a speed less than said first speed; the combination therewith comprising at least one knockdown wheel having a generally circular periphery and a center axis of rotation, said knockdown wheel having a plurality of knockdown elements supported about said periphery at least equal in number to the number of knife blades on said knife cylinder that establish said trailing edges of said printed products severed from said web, said knockdown wheel enabling adjustable positioning of said knockdown elements about said periphery in [angular] circumferentially spaced positions corresponding to the [angular] circumferentially spaced positions of said knife blades that establish said trailing edges, and means for supporting said knockdown wheel adjacent said upstream end of said second conveyor for rotation about said center axis in rotational phase relation to rotation of said knife cylinder such that said knockdown elements depress each successive printed product generally adjacent its trailing edge as said irregularly spaced printed products pass from said first to said second conveyor.

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Amend claim 19 as follows:

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14. *16.* (Amended) Apparatus for making a plurality of printed products from a continuous web comprising, in combination, a rotary print cylinder, means for effecting cooperation between the web and said print cylinder so as to create a plurality of [generally equal length] printed products on a repeat length of the web during each rotational repeat of said print cylinder and wherein the printed products are irregularly spaced between a leading edge and a trailing edge of each repeat length of web, a rotary cutter having a plurality of circumferentially spaced knife blades thereon[.

means for effecting cooperation between] cooperative with said repeat length of web [and said variable rotary cutter] so that said knife blades sever the web and create discrete irregularly spaced [equal length] printed products having leading and trailing edges, first conveyor means for conveying the severed irregularly spaced printed products from said rotary cutter along a first conveyor path at a first speed, second conveyor means for conveying the severed irregularly spaced printed products from said first conveyor path along a second conveyor path at a second speed less than said first speed, said second conveyor path having an upstream end positioned to receive said severed irregularly spaced printed products from said first conveyor path, and at least one knockdown wheel having an axis of rotation and a generally circular periphery and having a plurality of knockdown elements adjustable about said periphery, said knockdown elements being at least equal in number to and positioned at substantially corresponding [angular] circumferentially spaced positions about said axis of rotation as are said knife blades on said rotary cutter that create said trailing edges of said printed products severed from said repeat length of said web, said knockdown wheel being positioned generally adjacent said upstream end of said second conveyor path so that effecting rotation of said wheel about said axis of rotation in predetermined phase relation to said rotary cutter causes said knockdown elements to each engage and depress a discrete printed product received from said first conveyor path generally adjacent [its] the trailing edge thereof and [to] enable the leading edge of each successive printed product received from said first conveyor path to pass over the trailing edge of the preceding printed product in shingled fashion.

[Amend claim 20 as follows:]

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20. (Amended) In apparatus for conveying irregularly spaced printed products from a first conveyor to a second conveyor traveling at a slower speed than the first conveyor, and wherein said printed products have leading and trailing edges and are formed by a rotary cutter from

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predetermined equal lengths of a continuous web so that each predetermined length of web has an equal number of irregularly spaced [equal length] printed products formed therefrom; the improvement comprising a knockdown wheel supported adjacent an upstream end of the second conveyor and operative to engage the trailing edge of each successive printed product as it is conveyed from said first to said second conveyor, said knockdown wheel having an axis of rotation and a substantially circular periphery, and a plurality of knockdown elements mounted on said periphery so as to enable selective [angular adjustment] circumferentially spaced positioning of said knockdown elements about said axis of rotation, said knockdown elements being ^{at least} equal in number to the number of said printed products formed from each said predetermined length of web and being positioned so that upon rotating said knockdown wheel in predetermined phase relation to said rotary cutter[,] said knockdown elements engage and depress said trailing edges of said irregularly spaced products as they are conveyed from said first to said second conveyor whereby to facilitate shingling of said conveyed printed products.

Amend claim 21 as follows:

16. 21. (Amended) A method for making a plurality of printed products from a continuous web, comprising the steps of:

effecting cooperation between the web and a rotatable print cylinder so as to create a plurality of [generally equal length] printed products on a repeat length of the web during each rotational repeat of said print cylinder and wherein the printed products are irregularly spaced between a leading edge and a trailing edge of each repeat length of web,

effecting cooperation between said repeat length of web and a variable rotary cutter having a plurality of circumferentially spaced knife blades operative to sever the web so as to create

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discrete [generally equal length] irregularly spaced printed products having leading and trailing edges,

conveying the severed irregularly spaced printed products from said rotary cutter along a first conveyor path at a first speed,

conveying the severed irregularly spaced printed products from said first conveyor path along a second conveyor path at a second speed less than said first speed, said second conveyor path having an upstream end positioned to receive said severed printed products from said first conveyor path,

B4 providing at least one knockdown wheel having a center axis and a generally circular periphery and having a plurality of knockdown elements adjustable about said periphery to correspond in number and [angular relation] circumferential spacing to said knife blades on said rotary cutter that create said trailing edges of said irregularly spaced printed products severed from a repeat length of said web, and

positioning said knockdown wheel generally adjacent said upstream end of said second conveyor path and effecting rotation of said wheel about said center axis in phase relation to said rotary cutter so that each of said knockdown elements engages and depresses a discrete printed product received from said first conveyor path generally adjacent its trailing edge so as to enable the leading edge of each successive printed product received from said first conveyor path to pass over the trailing edge of the preceding printed product in shingled fashion.

Add claims 23-31 as follows:

B1 18. 28. Apparatus for shingling successive sheet products cut from a substantially continuous web of sheet material, said apparatus comprising, in combination, a variable rotary cutter having a plurality of knife blades having cutting edges operative to cut the web generally

transversely into irregularly spaced sheet products having leading and trailing edges, a first conveyor for receiving said sheet products in successive fashion from said rotary cutter and defining a first conveyor path along which said successive sheet products are conveyed in irregularly spaced relation at a first longitudinal speed, a second conveyor having an upstream end for receiving said sheet products in successive fashion from said first conveyor and defining a second conveyor path along which said sheet products are conveyed at a slower longitudinal speed than said first longitudinal speed, at least one rotary knockdown wheel supported generally adjacent said upstream end of said second conveyor and having a plurality of knockdown members adjustable about an outer periphery of said wheel, said knockdown members being ^{at least} equal in number to the number of knife blades on said rotary cutter that establish said trailing edges of said irregularly spaced sheet products and being positioned about the outer periphery of said wheel so that said knockdown members are operative to engage and depress successive sheet products generally adjacent their trailing edges as said irregularly spaced sheet products pass from said first conveyor to said second conveyor whereby to enable shingling of successive sheet products, and drive mechanism for rotating said knockdown wheel so that said knockdown members have a tangential velocity substantially equal to the tangential velocity of said knife cutting edges during operation of said apparatus.

19. 24. Apparatus as defined in claim 23 wherein said knockdown wheel has a center axis of rotation, said knockdown members being disposed in generally radial relation to said center axis.

20. 25. Apparatus as defined in claim 24 wherein said knockdown members lie substantially in a common plane transverse to said axis of rotation of said knockdown wheel.

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Apparatus as defined in claim 24 wherein said knockdown members include brush bristles defining outer contact surfaces operative to engage and depress said successive sheet products as said sheet products pass from said first to said second conveyors.

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Apparatus as defined in claim 23 including a brake pad cooperative with said knockdown wheel so as to decelerate each said successive sheet product as it passes to said second conveyor.

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Apparatus as defined in claim 23 wherein said drive mechanism is operative to varying the rotational phase relation between said rotary cutter and said knockdown wheel so as to vary the point of engagement of said knockdown members with said sheet products relative to the trailing edges of said sheet products.

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Apparatus as defined in claim 23 wherein said drive mechanism comprises a harmonic drive operatively associated with said rotary cutter and said knockdown wheel.

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Apparatus as defined in claim 23 wherein said drive mechanism includes a differential gear drive operatively associated with said rotary cutter and said knockdown wheel.

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Apparatus as defined in claim 23 including a headstop means operatively associated with said second conveyor so as to engage a leading edge of each successive printed product and effect deceleration thereof as said product passes to said second conveyor, said headstop means being positioned to be engaged by the leading edge of a printed product when the trailing edge of said product is adjacent the upstream end of said second conveyor.

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